U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: APPROVAL GUIDANCE FOR RNP PROCEDURES WITH SAAAR	**Date: 12/15/05**	**AC No: 90-101**
	Initiated by: AFS-400	

1. PURPOSE.

a. This advisory circular (AC) provides airworthiness and operational approval guidance material for aircraft operators conducting Title 14 of the Code of Federal Regulations (14 CFR) part 97 Area Navigation (RNAV) Required Navigation Performance (RNP) instrument approach procedures with Special Aircraft and Aircrew Authorization Required (SAAAR), charted as "RNAV (RNP) RWY XX". Hereafter, these procedures will be referred to as "RNP SAAAR".

b. This AC provides a method of compliance with public RNP SAAAR instrument approach procedure (IAP) requirements. In lieu of following this method without deviation, operators may elect to follow an alternative method, provided the alternative method is also found to be acceptable by the Federal Aviation Administration (FAA).

c. Mandatory terms used in this AC such as "must" are used only in the sense of ensuring applicability of these particular methods of compliance when the acceptable means of compliance described herein are used. This AC does not change, add, or delete regulatory requirements or authorize deviations from regulatory requirements.

2. RELATED CODE OF FEDERAL REGULATIONS SECTIONS. 14 CFR

a. Part 91, sections 91.175, 91.123, 91.205,

b. Part 97, section 97.20,

c. Part 121, section 121.349,

d. Part 125, section 125.203,

e. Part 129, section 129.17, and

f. Part 135, section 135.165.

3. DEFINITIONS.

a. Area Navigation (RNAV). A method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

b. Estimate of Position Uncertainty (EPU). A measure based on a defined scale in nautical miles, which conveys the current position estimation performance, also known as Actual

Navigation Performance (ANP) and Estimate of Position Error (EPE) in certain aircraft. The EPU is not an estimate of the actual error, but a defined statistical indication.

c. Flight Management System (FMS). An integrated system, consisting of airborne sensor, receiver and computer with both navigation and aircraft performance databases, which provides performance and RNAV guidance to a display and automatic flight control system.

d. Global Positioning System (GPS). GPS is a U.S. satellite based radio navigation system that provides a positioning service anywhere in the world. The service provided by GPS for civil use is defined in the GPS Standard Positioning System Signal Specification.

e. Global Navigation Satellite System (GNSS). GNSS is a generic term for satellite-based navigation, including GPS, Satellite Based Augmentation Systems (SBAS) such as the Wide Area Augmentation System (WAAS), Ground-Based Augmentation System (GBAS) such as the Local Area Augmentation System (LAAS), Global Orbiting Navigation Satellite System (GLONASS) and any other satellite navigation system.

f. Primary Optimum Field of View. For the purpose of this AC, the primary optimum field of view is within 15 degrees of the pilot's primary line of sight.

g. Radius to a Fix (RF) Leg. An RF leg is defined as a constant radius circular path around a defined turn center that starts and terminates at a fix. An RF leg may be published as part of a procedure.

h. Receiver Autonomous Integrity Monitoring (RAIM). An algorithm that verifies the integrity of the position output using GPS measurements, or GPS measurements and barometric aiding.

i. Required Navigation Performance (RNP). Required Navigation Performance is a statement of the navigation performance necessary for operation within a defined airspace.

j. RNP Value. The RNP value designates the lateral performance requirement associated with a procedure. Examples of RNP values are: RNP 0.3 and RNP 0.15.

k. Special Aircraft and Aircrew Authorization Required (SAAAR). Special authorization by the FAA is required to conduct RNP approaches designated as “Special Aircraft and Aircrew Authorization Required.”

4. RELATED DOCUMENTS.

a. RTCA, Inc. Documents. Copies of the following RTCA documents may be obtained from RTCA, Inc., 1828 L Street, NW, Suite 805, Washington, DC 20036, or purchased on-line at http://www.rtca.org/.

(1) RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification.

(2) RTCA/DO-187, Minimum Operational Performance Standards for Airborne Area Navigation Equipment Using Multi-Sensor Inputs.

(3) RTCA/DO-189, Minimum Performance Standard for Airborne Distance Measuring Equipment (DME) Operating Within the Radio Frequency Range of 960-1215 Megahertz

(4) RTCA/DO-200A, Standards for Processing Aeronautical Data.

(5) RTCA/DO-201A, User Recommendations for Aeronautical Information Services.

(6) RTCA/DO-208, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS).

(7) RTCA/DO-229C, Minimum Operations Performance Standards for Airborne GPS/Wide Area Augmentation System Equipment.

(8) RTCA/DO-236B, Minimum Aviation System Performance Standards: Required Navigation Performance for Area Navigation.

(9) RTCA/DO-283A, Minimum Operational Performance Standards for Required Navigation Performance for Area Navigation.

b. FAA Technical Standard Orders (TSO). Copies of the following TSOs may be obtained from the U.S. Department of Transportation, Publications Department, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.

(1) TSO-C115B, Airborne Area Navigation Equipment Using Multi-Sensor Inputs.

(2) TSO-C129A, Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS).

(3) TSO C145A, Airborne Navigation Sensors Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS).

(4) TSO C146A, Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS).

c. FAA Orders. Copies of the following orders may be purchased from the U.S. Department of Transportation, Publications Department, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.

(1) Order 8400.12A, Required Navigation Performance 10 (RNP 10) Operational Approval.

(2) Order 8260.52, United States Standard For Required Navigation Performance (RNP) Approach Procedures With Special Aircraft and Aircrew Authorization Required (SAAAR).

d. FAA Advisory Circulars (AC), as Amended. Copies of the following ACs may be obtained from the U.S. Department of Transportation, Publications Department, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD, 20785.

(1) AC 20-129, Airworthiness Approval for Vertical Navigation (VNAV) Systems for Use in the U.S. National Airspace System (NAS) and Alaska

(2) AC 20-130A, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors.

(3) AC 20-138A, Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for Use as a VFR and IFR Supplemental Navigation System.

(4) AC 20-153, Acceptance of Data Processes and Associated Navigation Databases.

(5) AC 25-1309-1A, System Design and Analysis.

(6) AC 25-4, Inertial Navigation Systems (INS).

(7) AC 25-15, Approval of Flight Management Systems in Transport Category Airplanes.

(8) AC 23-1309-1C, Equipment, Systems and Installations in Part 23 Airplanes

(9) AC 90-45A, Approval of Area Navigation Systems for Use in the U.S. National Airspace System.

(10) AC 90-94**,** Guidelines for Using Global Positioning System Equipment for IFR En Route and Terminal Operations and for Nonprecision Instrument Approaches in the U.S. National Airspace System.

(11) AC 120-29A, Criteria for Approval of Category I and Category II Weather Minima for Approach.

5. BACKGROUND. RNP approaches provide an opportunity to improve safety, efficiency and capacity. Safety is improved when RNP approaches replace visual or non-precision approaches, and efficiency is improved through more repeatable and optimum flight paths. Capacity can be improved by de-conflicting traffic during instrument conditions.

a. RNP SAAAR approaches provide an unprecedented flexibility in construction of approach procedures. These operations are area navigation procedures with a specified level of performance and capability. RNP SAAAR approach procedures build upon the performance based National Airspace System (NAS) concept. The performance requirements to conduct an approach are defined, and aircraft are qualified against these performance requirements. Conventional obstacle evaluation areas for ground-based navigation aids are based on a predefined aircraft capability and navigation system. RNP SAAAR criteria for obstacle evaluation are flexible and designed to adapt to unique operational environments. This allows approach specific performance requirements as necessary for that approach procedure. The

operational requirement can include avoiding terrain or obstacles, de-conflicting airspace, or resolving environmental constraints.

b. RNP approaches include unique capabilities that require special aircraft and aircrew authorization similar to Category (CAT) II/III ILS operations. All RNP SAAAR approaches have reduced lateral obstacle evaluation areas and vertical obstacle clearance surfaces predicated on the aircraft and aircrew performance requirements of this AC. In addition, there are two characteristics used for selected procedures, as necessary. Operators can be authorized for any subset of these characteristics:

- Ability to fly a published arc (also referred to as a RF leg)
- Reduced lateral obstacle evaluation area on the missed approach (also referred to as a missed approach requiring RNP less than 1.0)

c. When conducting a RNP SAAAR approach using a line of minima less than RNP 0.3 and/or a missed approach that requires RNP less than 1.0, you must comply with Appendix 2, paragraph 5 and/or paragraph 6.

d. A critical component of RNP is the ability of the aircraft navigation system to monitor its achieved navigation performance, and to identify for the pilot whether the operational requirement is or is not being met during an operation.

6. APPROVAL.

a. Overview. Any operator with an appropriate operational approval (i.e., Operations Specifications (OpsSpec), Letter of Authorization (LOA), or Management Specifications (Mspecs)) may conduct specified RNP SAAAR instrument approach procedures, in a similar manner that operators with the proper authorization may conduct CAT II and CAT III ILS operations. Appendix 7 contains a checklist and a list of the documents operators should submit when seeking approval for these operations. Operators should comply with the requirements in Appendices 2 through 6. Prior to application, operators and manufacturers should review all performance requirements. Installation of equipment by itself does not guarantee final approval for use.

b. Aircraft Qualification and Initial Acceptance of Recommended Operational Documentation.

(1) Aircraft Qualification Documentation. Aircraft manufacturers should develop aircraft qualification documentation showing compliance with Appendix 2. This documentation identifies the optional capabilities (e.g., RF legs and RNP missed approaches), the RNP capability of each aircraft configuration, and the characteristics that may alleviate the need for operational mitigations. This documentation should also define the recommended RNP maintenance procedures.

(2) RNP SAAAR Operational Documentation. It is recommended that the aircraft manufacturer develop RNP SAAAR operational documentation. The operational documentation consists of recommended navigation data validation program (Appendix 3), operational

considerations (Appendix 4), training programs (Appendix 5), and RNP monitoring programs (Appendix 6).

(3) FAA Acceptance.

(a) For new aircraft, the aircraft qualification documentation can be approved as part of an aircraft certification project and reflected in the AFM and related documents. The RNP SAAAR operational documentation can be accepted by the Aircraft Evaluation Group (AEG) in coordination with Flight Technologies and Procedures Division, AFS-400.

(b) For existing aircraft, the aircraft manufacturer should submit the aircraft qualification and RNP SAAAR operational documentation to Flight Technologies and Procedures Division, AFS-400. AFS-400 will coordinate with other FAA offices and may accept the package as appropriate for RNP SAAAR operations. This acceptance will be documented in a letter to the aircraft manufacturer.

c. Operator Approval.

Part 91, 91 subpart K, 121, 125, 129, or 135 operators should present evidence of compliance with FAA accepted aircraft qualification and operational documentation to their FSDO/CHDO, as described in Appendix 7. This documentation addresses compliance with appendices 2 through 6 and is specific to the aircraft equipment and procedures. Once the operator has satisfied the requirements of this AC, or equivalent, the FSDO/CHDO issues Operations Specifications (OpSpecs), Management Specifications (Mspecs), or an LOA authorizing RNP approach procedures with SAAAR.

(1) Interim Authorization. For the first 90 days and at least 100 SAAAR approaches in each aircraft type, the operator will be authorized to conduct RNP approaches with SAAAR using minima associated with RNP 0.3. For approach procedures with no line of minima associated with RNP 0.3, the procedure must be flown in Visual Meteorological Conditions (VMC). The interim authorization will be removed after completion of the applicable time period and number of approaches and upon FAA review of the reports from the RNP SAAAR monitoring program.

NOTE 1: RNP SAAAR operators with experience of equivalent RNP approaches may receive credit toward the interim authorization requirements.

NOTE 2: Experienced RNP SAAAR operators operating new or upgraded aircraft types/systems, derivative types, or different aircraft types with identical crew interface and procedures, may use reduced interim authorization periods (e.g., less than 90 days and 100 approaches) as determined by the CHDO/FSDO.

NOTE 3: In unique situations where the completion of 100 successful approaches could take an unreasonably long period of time due to factors such as a small number of aircraft in the fleet, limited opportunity to use runways having appropriate procedures, and equivalent reliability can be achieved, a reduction in the required number of approaches may be considered on a case-by-case basis.

(2) Final Authorization. The CHDO/FSDO will issue OpSpecs, Mspecs, or LOA authorizing use of lowest applicable minima after operators satisfactorily complete their initial 90 day / 100 RNP SAAAR approach demonstration period.

(3) Aircraft Modification. If any aircraft system required for RNP SAAAR is modified (e.g., software or hardware change), the aircraft modification must be approved. The operator must obtain a new operational approval supported by the manufacturer's updated aircraft qualification and operational documentation.

/s/

James J. Ballough
Director, Flight Standards Service

APPENDIX 1. RNP SAAAR INSTRUMENT APPROACH PROCEDURES

1. INTRODUCTION. The procedure design criteria for RNP SAAAR approaches is defined by the United States Standard for Terminal Instrument Procedures (TERPS). This appendix provides a summary of the key characteristics of approach procedures and introduces the types of RNP approach operations. Sample approach plates are shown in Figures 1 and 2.

2. UNIQUE CHARACTERISTICS OF RNP SAAAR APPROACHES.

a. RNP Value. Each published line of minima has an associated RNP value. For example, Figure 2 shows both RNP 0.3 and RNP 0.15 approaches. A minimum RNP value is documented as part of the RNP SAAAR authorization for each operator and may vary depending on aircraft configuration or operational procedures (e.g., GPS inoperative, use of flight director with or without autopilot).

b. Procedures with RF Legs. Some RNP approaches have a curved path, also called a radius-to-a-fix (RF) leg. Since not all aircraft have the capability to fly these leg types, pilots are responsible for knowing if they can conduct an RNP approach with an RF leg. Requirements for RF legs will be indicated on the approach chart in the notes section or at the applicable initial approach fix. An example of an RF leg is shown in Figure 1 (e.g., between SKYCO and CATMI).

c. Missed Approaches requiring less than RNP 1.0. At designated locations, the airspace or obstacle environment will require RNP capability of less than 1.0 during a missed approach from anywhere on the procedure. At these locations the reliability of the navigation system must be very high. Operation on these approaches typically requires redundant equipment, as no single point of failure can cause loss of RNP capability. An example of a missed approach requiring RNP less than 1.0 is shown in Figure 2, as indicated in the notes section of the chart.

d. Non-standard Speeds or Climb Gradients. RNP SAAAR approaches are developed based on standard approach speeds and a 200 ft/NM climb gradient in the missed approach. Any exceptions to these standards will be indicated on the approach procedure, and the operator must ensure they can comply with any published restrictions before conducting the operation. An example of a non-standard climb gradient is shown in Figure 2, as indicated in the notes section of the chart.

e. Temperature Limits.

(1) For aircraft using barometric vertical navigation without temperature compensation to conduct the approach, low and high-temperature limits are identified on the procedure. Cold temperatures reduce the glidepath angle while high temperatures increase the glidepath angle.

(2) Aircraft using barometric vertical navigation with temperature compensation or aircraft using an alternate means for vertical guidance (e.g., SBAS) may disregard the temperature restrictions. Example temperature limits are shown in Figure 1 between -5°C and +40° C.

(3) Since the charted temperature limits are evaluated solely for obstacle clearance in the final approach segment and temperature compensation only affects the vertical guidance, the pilot may need to manually adjust the minimum altitude on the initial and intermediate approach segments and the decision altitude height (DA (H)).

NOTE: Temperature affects the indicated altitude. The effect is similar to high and low pressure changes, although not as significant as pressure changes. When temperature is higher than standard (ISA), the aircraft will be higher than indicated altitude. When temperature is lower than standard, the aircraft will be lower than indicated on the altimeter. For additional information, refer to the Altimeter Errors paragraph in the Aeronautical Information Manual (AIM).

f. Aircraft size. The achieved minimums may be dependent on aircraft size. Large aircraft may require higher minimums due to gear height and/or wingspan. Approach procedure charts will be annotated with applicable aircraft size restrictions when appropriate. (See Figure 1 Notes)

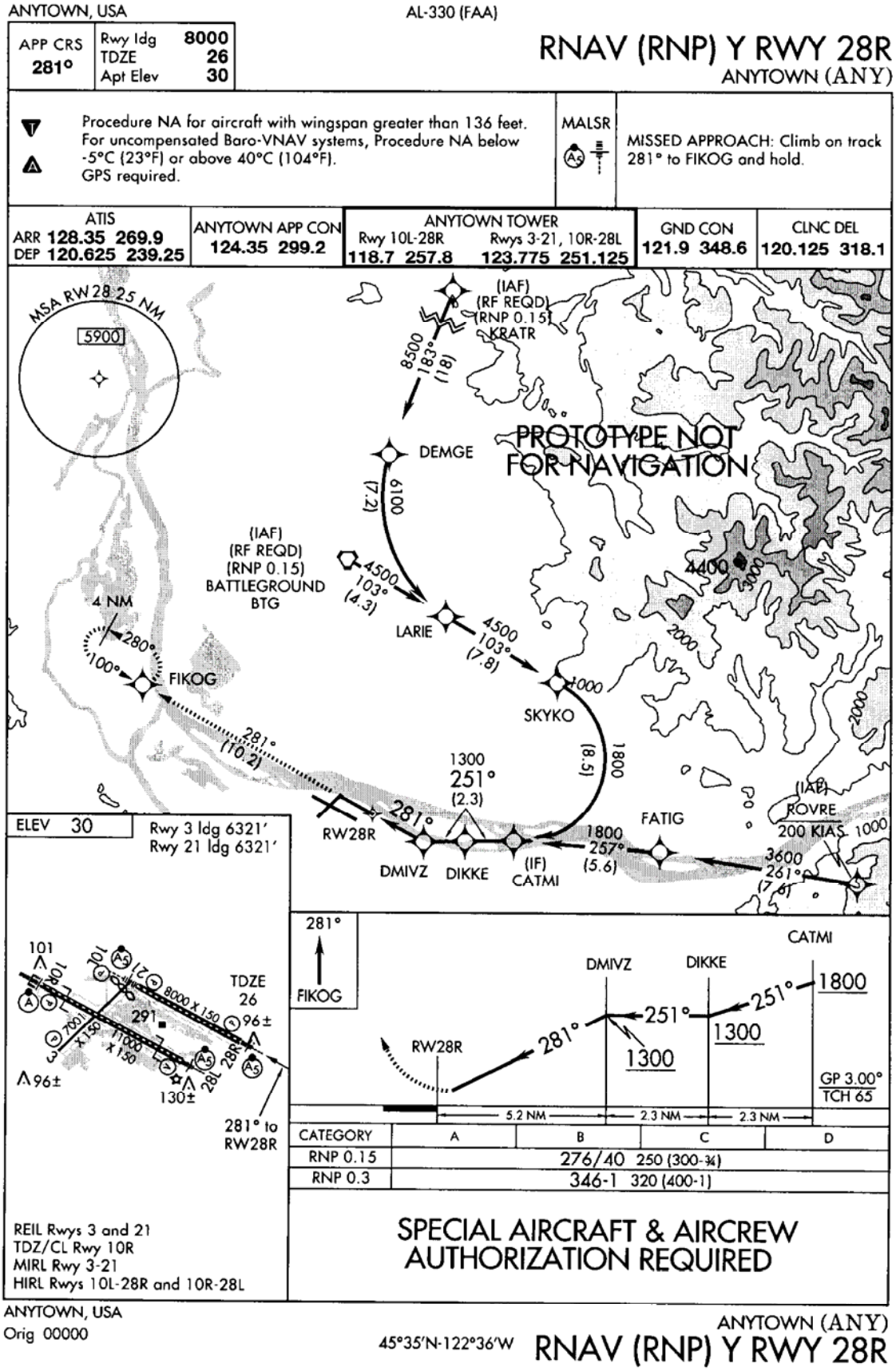
ANYTOWN, USA
AL-330 (FAA)
APP CRS 281°
Rwy Idg 8000
TDZE 26
Apt Elev 30
RNAV (RNP) Y RWY 28R
ANYTOWN (ANY)
Procedure NA for aircraft with wingspan greater than 136 feet.
For uncompensated Baro-VNAV systems, Procedure NA below -5°C (23°F) or above 40°C (104°F).
GPS required.
MALSR
MISSED APPROACH: Climb on track 281° to FIKOG and hold.
ATIS
ARR 128.35 269.9
DEP 120.625 239.25
ANYTOWN APP CON
124.35 299.2
ANYTOWN TOWER
Rwy 10L-28R Rwys 3-21, 10R-28L
118.7 257.8 123.775 251.125
GND CON
121.9 348.6
CLNC DEL
120.125 318.1
MSA RW 28 25 NM
5900
(IAF)
(RF REQD)
(RNP 0.15)
KRATR
8500
183°
(18)
DEMGE
6100
(7.2)
PROTOTYPE NOT FOR NAVIGATION
(IAF)
(RF REQD)
(RNP 0.15)
BATTLEGROUND
BTG
4500
103°
(4.3)
LARIE
4500
103°
(7.8)
4400
3000
2000
4 NM
280°
100°
FIKOG
SKYKO
1000
2000
281°
(10.2)
1300
251°
(2.3)
1800
(8.5)
(IAF)
ROVRE
200 KIAS
1000
FATIG
1800
257°
(5.6)
3600
261°
(7.6)
RW28R
281°
DMIVZ
DIKKE
(IF)
CATMI
ELEV 30
Rwy 3 ldg 6321'
Rwy 21 ldg 6321'
101
TDZE
26
96±
8000 X 150
7000 X 150
11000 X 150
291
130±
28L
28R
281° to RW28R
281°
FIKOG
CATMI
DMIVZ
DIKKE
RW28R
281°
251°
1300
251°
1800
1300
GP 3.00°
TCH 65
5.2 NM
2.3 NM
2.3 NM
CATEGORY A B C D
RNP 0.15 276/40 250 (300-¾)
RNP 0.3 346-1 320 (400-1)
REIL Rwys 3 and 21
TDZ/CL Rwy 10R
MIRL Rwy 3-21
HIRL Rwys 10L-28R and 10R-28L
SPECIAL AIRCRAFT & AIRCREW AUTHORIZATION REQUIRED
ANYTOWN, USA
Orig 00000
45°35'N-122°36'W
ANYTOWN (ANY)
RNAV (RNP) Y RWY 28R

Figure 1.

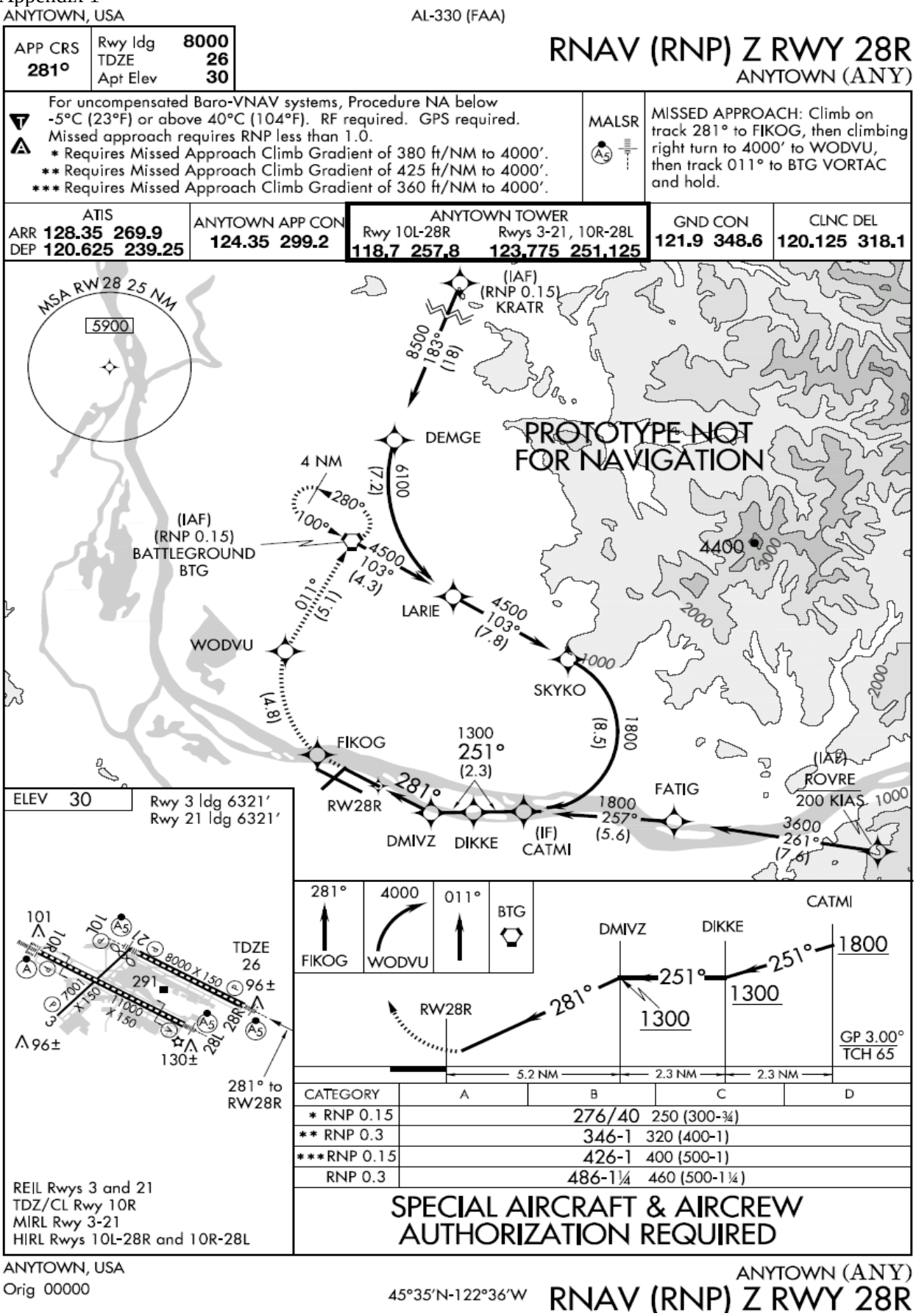
ANYTOWN, USA
AL-330 (FAA)
APP CRS 281°
Rwy ldg 8000
TDZE 26
Apt Elev 30
RNAV (RNP) Z RWY 28R
ANYTOWN (ANY)
For uncompensated Baro-VNAV systems, Procedure NA below -5°C (23°F) or above 40°C (104°F). RF required. GPS required.
Missed approach requires RNP less than 1.0.
* Requires Missed Approach Climb Gradient of 380 ft/NM to 4000'.
** Requires Missed Approach Climb Gradient of 425 ft/NM to 4000'.
*** Requires Missed Approach Climb Gradient of 360 ft/NM to 4000'.
MALSR
MISSED APPROACH: Climb on track 281° to FIKOG, then climbing right turn to 4000' to WODVU, then track 011° to BTG VORTAC and hold.
ATIS
ARR 128.35 269.9
DEP 120.625 239.25
ANYTOWN APP CON
124.35 299.2
ANYTOWN TOWER
Rwy 10L-28R Rwys 3-21, 10R-28L
118.7 257.8 123.775 251.125
GND CON
121.9 348.6
CLNC DEL
120.125 318.1
MSA RW 28 25 NM
5900
(IAF)
(RNP 0.15)
KRATR
8500
183°
(18)
DEMGE
PROTOTYPE NOT FOR NAVIGATION
4 NM
280°
100°
6100
(7.2)
(IAF)
(RNP 0.15)
BATTLEGROUND
BTG
4500
103°
(4.3)
011°
(5.1)
LARIE
4500
103°
(7.8)
WODVU
(4.8)
SKYKO
1000
1800
(8.5)
FIKOG
1300
251°
(2.3)
281°
RW28R
DMIVZ
DIKKE
(IF)
CATMI
FATIG
1800
257°
(5.6)
(IAF)
ROVRE
200 KIAS
1000
3600
261°
(7.6)
4400
3000
2000
2000
ELEV 30
Rwy 3 ldg 6321'
Rwy 21 ldg 6321'
TDZE
26
96±
291
8000 X 150
7001 X 150
1000 X 150
96±
130±
281° to RW28R
281°
FIKOG
4000
WODVU
011°
BTG
CATMI
DMIVZ
DIKKE
RW28R
281°
251°
1300
251°
1800
1300
GP 3.00°
TCH 65
5.2 NM
2.3 NM
2.3 NM
CATEGORY A B C D
* RNP 0.15 276/40 250 (300-¾)
** RNP 0.3 346-1 320 (400-1)
***RNP 0.15 426-1 400 (500-1)
RNP 0.3 486-1¼ 460 (500-1¼)
SPECIAL AIRCRAFT & AIRCREW AUTHORIZATION REQUIRED
REIL Rwys 3 and 21
TDZ/CL Rwy 10R
MIRL Rwy 3-21
HIRL Rwys 10L-28R and 10R-28L
ANYTOWN, USA
Orig 00000
45°35'N-122°36'W
ANYTOWN (ANY)
RNAV (RNP) Z RWY 28R

Figure 2.

APPENDIX 2. AIRCRAFT QUALIFICATION

1. INTRODUCTION.

This appendix describes the aircraft performance and functional criteria for aircraft to qualify for Required Navigation Performance (RNP) Special Aircraft and Aircrew Authorization Required (SAAAR) approaches. Applicants may establish compliance with this appendix as part of a type certification or supplemental type certification and document this in the Aircraft Flight Manual (Supplement). The type certificate holder of a previously certified aircraft can document compliance with these aircraft qualification criteria without a new airworthiness project (e.g., without AFM change), and should advise the appropriate ACO of any new performance not covered by the original airworthiness approval. The AFM or other aircraft qualification evidence should address normal and abnormal flight crew operating procedures, responses to failure alerts, and any limitations, including related information on the modes of operation required to fly an RNP SAAAR approach.

In addition to the specific RNP SAAAR guidance in this document, the aircraft must comply with AC 20-129 and either AC 20-130 or AC 20-138.

2. PERFORMANCE REQUIREMENTS. This paragraph defines the general performance requirements for aircraft qualification. Paragraphs 3, 4, and 5 of this Appendix provide guidance material on an acceptable means of satisfying these requirements.

a. Path Definition. Aircraft performance is evaluated around the path defined by the published procedure and RTCA/DO-236B Section 3.2. All vertical paths used in conjunction with the final approach segment will be defined by a Flight Path Angle (RTCA/DO-236B Section 3.2.8.4.3) as a straight line emanating to a fix and altitude.

b. Lateral Accuracy. The aircraft must comply with Section 2.1.1 of RTCA/DO-236B.

c. Vertical Accuracy. The vertical system error includes altimetry error (assuming the temperature and lapse rates of the International Standard Atmosphere), the effect of along-track error, system computation error, data resolution error, and flight technical error. The 99.7% of system error in the vertical direction must be less than the following (in feet):

$$\sqrt{((6076.115)(1.225)\mathbf{RNP}\cdot tan\theta)^2+(60tan\theta)^2+75^2+\left(\left(-8.8\cdot10^{-8}\right)(\mathbf{h}+\Delta\mathbf{h})^2+\left(6.5\cdot10^{-3}\right)(\mathbf{h}+\Delta\mathbf{h})+50\right)^2}$$

where θ is the vertical navigation (VNAV) path angle, h is the height of the local altimetry reporting station and Δh is the height of the aircraft above the reporting station.

d. Airspace Containment. RNP SAAAR approaches are published as performance-based approaches. As such, they do not inherently require any specific technology or procedure, but instead require a level of performance.

(1) RNAV and Barometric VNAV. Establishing compliance to the required level of performance can be difficult. This AC provides a detailed acceptable means of compliance for aircraft that use an area navigation (RNAV) system based primarily on GNSS and a VNAV system based on barometric altimetry. Paragraphs 3, 4, and 5 of this Appendix in conjunction

with guidance described in Appendices 3 and 4 describe an acceptable means of achieving the required navigation performance. Aircraft and operations that comply with these paragraphs provide the requisite airspace containment.

(2) Other systems or alternate means of compliance. For other systems or alternate means of compliance, the probability of the aircraft exiting the lateral and vertical extent of the obstacle clearance volume (Order 8260.52) must not exceed 10^{-7} per approach, including the approach and missed approach. This requirement may be satisfied by an operational safety assessment applying (a) appropriate quantitative numerical methods, (b) qualitative operational and procedural considerations and mitigations, or (c) an appropriate combination of both quantitative and qualitative methods.

NOTE 1: This requirement applies to the total probability of excursion outside the obstacle clearance volume, including events caused by latent conditions (integrity) and by detected conditions (continuity) if the aircraft does not remain within the obstacle clearance volume after the failure is annunciated. The monitor limit of the alert, the latency of the alert, the crew reaction time, and the aircraft response should all be considered when ensuring that the aircraft does not exit the obstacle clearance volume. The requirement applies to a single approach, considering the exposure time of the operation and the NAVAID geometry and navigation performance available for each published approach.

NOTE 2: This containment requirement derives from the operational requirement. This requirement is notably different than the containment requirement specified in RTCA/DO-236B. The requirement in RTCA/DO-236B was developed to facilitate airspace design and does not directly equate to obstacle clearance.

e. System Monitoring. A critical component of RNP are the RNP requirements of the approach, the ability of the aircraft navigation system to monitor its achieved navigation performance, and to identify for the pilot whether the operational requirement is or is not being met during an operation.

3. RNP SAAAR GENERAL REQUIREMENTS.

NOTE: Additional guidance and information concerning many of the required functions is provided in RTCA/DO-236B.

a. Position Estimation. The navigation system must estimate the aircraft's position. This section identifies unique issues for the navigation sensors within the context of RNP SAAAR approaches.

(1) Global Positioning System (GPS).

(a) The sensor must comply with the guidelines in AC 20-138(). For systems that comply with AC 20-138(), the following sensor accuracies can be used in the total system accuracy analysis without additional substantiation: GPS sensor accuracy is better than 36 meters (95%), and augmented GPS (GBAS or SBAS) sensor accuracy is better than 2 meters (95%).

(b) In the event of a latent GPS satellite failure and marginal GPS satellite geometry (e.g., Horizontal Integrity Limit (HIL) equal to the horizontal alert limit), the probability that the total system error remains within the obstacle clearance volume used to evaluate the procedure must be greater than 95% (both laterally and vertically).

NOTE: GNSS-based sensors output a HIL, also known as a Horizontal Protection Level (HPL) (see AC 20-138A Appendix 1 and RTCA/DO-229C for an explanation of these terms). The HIL is a measure of the position estimation error assuming a latent failure is present. In lieu of a detailed analysis of the effects of latent failures on the total system error, an acceptable means of compliance for GNSS-based systems is to ensure the HIL remains less than twice the RNP value, minus the 95% of FTE, during the RNP SAAAR operation.

(2) Inertial Reference System (IRS). An inertial reference system must satisfy the criteria of 14 CFR part 121, Appendix G. While Appendix G defines the requirement for a 2 NM per hour drift rate (95%) for flights up to 10 hours, this rate does not apply to an RNAV system after loss of position updating. Systems that have demonstrated compliance with part 121, Appendix G can be assumed to have an initial drift rate of 4 NM for the first 30 minutes (95%) without further substantiation. Aircraft manufacturers and applicants can demonstrate improved inertial performance in accordance with the methods described in appendix 1 or 2 of FAA Order 8400.12A.

NOTE: Integrated GPS/INS position solutions reduce the rate of degradation after loss of position updating. For "tightly coupled" GPS/IRUs, RTCA/DO-229C, Appendix R, provides additional guidance.

(3) Distance Measuring Equipment (DME). Initiation of all RNP SAAAR procedures is based on GNSS updating. Except where specifically designated on a procedure as Not Authorized, DME/DME updating can be used as a reversionary mode during the approach or missed approach when the system complies with the RNP value. The manufacturer should identify any constraints on the DME infrastructure or the procedure for a given aircraft to comply with this requirement.

(4) VHF Omni-directional Range station (VOR). For the initial RNP SAAAR implementation, the RNAV system may not use VOR updating. The manufacturer should identify any constraints on the VOR infrastructure or the procedure for a given aircraft to comply with this requirement.

NOTE: This requirement does not imply an equipment capability must exist providing a direct means of inhibiting VOR updating. A procedural means for the flight crew to inhibit VOR updating or executing a missed approach if reverting to VOR updating may meet this requirement.

(5) For multi-sensor systems, there must be automatic reversion to an alternate RNAV sensor if the primary RNAV sensor fails. Automatic reversion from one multi-sensor system to another multi-sensor system is not required.

(6) The 99.7% aircraft altimetry system error for each aircraft (assuming the temperature and lapse rates of the International Standard Atmosphere) must be less than or equal to the following with the aircraft in the approach configuration:

$$\mathbf{ASE} = -8.8 \cdot 10^{-8} \cdot \mathbf{H}^2 + 6.5 \cdot 10^{-3} \cdot \mathbf{H} + 50 \text{ (ft)}$$

Where H is the true altitude of the aircraft.

(7) Temperature compensation systems. Systems that provide temperature-based corrections to the barometric VNAV guidance must comply with RTCA/DO-236B, Appendix H.2. This applies to the final approach segment. Compliance to this standard should be documented to allow the operator to conduct RNP approaches when the actual temperature is below or above the published procedure design limit.

b. Path Definition and Flight Planning.

(1) Maintaining Track and Leg Transitions. The aircraft must have the capability to execute leg transitions and maintain tracks consistent with the following paths:

(a) A geodesic line between two fixes;

(b) A direct path to a fix;

(c) A specified track to a fix, defined by a course; and

(d) A specified track to an altitude.

NOTE 1: Industry standards for these paths can be found in RTCA/DO-236B and ARINC Specification 424, which refer to them as TF, DF, CF, and FA path terminators. Also, certain procedures require RF legs as described in paragraph 4 of this Appendix. EUROCAE ED-75A/ RTCA DO-236B and ED-77/ DO-201A describe the application of these paths in more detail.

NOTE 2: The navigation system may accommodate other ARINC 424 path terminators (e.g., Heading to manual terminator (VM)); and the missed approach procedure may use these types of paths when there is no requirement for RNP containment.

(2) Fly-By and Fly-Over Fixes. The aircraft must have the capability to execute fly-by and fly-over fixes. For fly-by turns, the navigation system must limit the path definition within the theoretical transition area defined in RTCA/DO-236B under the wind conditions identified in FAA Order 8260.52. The fly-over turn is not compatible with RNP flight tracks, and will only be used when there is no requirement for RNP containment.

(3) Waypoint Resolution Error. The navigation database must provide sufficient data resolution to ensure the navigation system achieves the required accuracy. Waypoint resolution error must be less than or equal to 60 feet, including both the data storage resolution and the RNAV system computational resolution used internally for construction of flight plan waypoints. The navigation database must contain vertical angles (flight path angles) stored to a resolution of hundredths of a degree, with computational resolution such that the system-defined path is within 5 ft of the published path.

(4) Capability for a "Direct-To" Function. The navigation system must have a "Direct-To" function the flight crew can activate at any time. This function must be available to any fix. The navigation system must also be capable of generating a geodesic path to the designated "To" fix, without "S-turning" and without undue delay.

(5) Capability to define a vertical path. The navigation system must be capable of defining a vertical path by a flight path angle to a fix. The system must also be capable of specifying a vertical path between altitude constraints at two fixes in the flight plan. Fix altitude constraints must be defined as one of the following:

(a) An "AT or ABOVE" altitude constraint (for example, 2400A, may be appropriate for situations where bounding the vertical path is not required);

(b) An "AT or BELOW" altitude constraint (for example, 4800B, may be appropriate for situations where bounding the vertical path is not required);

(c) An "AT" altitude constraint (for example, 5200); or

(d) A "WINDOW" constraint (for example, 2400A3400B).

NOTE: For RNP SAAAR approach procedures, any segment with a published vertical path will define that path based on an angle to the fix and altitude.

(6) Altitudes and/or speeds associated with published terminal procedures must be extracted from the navigation database.

(7) The system must be able to construct a path to provide guidance from current position to a vertically constrained fix.

(8) Capability to Load Procedures from the Navigation Database. The navigation system must have the capability to load the entire procedure(s) to be flown into the RNAV system from the onboard navigation database. This includes the approach (including vertical angle), the missed approach and the approach transitions for the selected airport and runway.

(9) Means to Retrieve and Display Navigation Data. The navigation system must provide the ability for the flight crew to verify the procedure to be flown through review of the data stored in the onboard navigation database. This includes the ability to review the data for individual waypoints and for navigation aids.

(10) Magnetic Variation. For paths defined by a course (CF and FA path terminators), the navigation system must use the magnetic variation value for the procedure in the navigation database.

(11) Changes in RNP Value. RNP changes to lower RNP values must be complete by the fix defining the leg with the lower RNP value. Any operational procedures necessary to accomplish this must be identified.

(12) Automatic Leg Sequencing. The navigation system must provide the capability to automatically sequence to the next leg and display the sequencing to the flight crew in a readily visible manner.

(13) A display of the altitude restrictions associated with flight plan fixes must be available to the pilot. If there is a specified navigation database procedure with a flight path angle associated with any flight plan leg, the equipment must display the flight path angle for that leg.

c. Demonstration of Path Steering Performance. Where the demonstration of RNP includes a demonstration of the path steering performance (flight technical error), the applicant must complete the demonstration in accordance with AC 120-29A, paragraphs 5.19.2.2 and 5.19.3.1.

d. Displays.

(1) Continuous Display of Deviation. The navigation system must provide the capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft, the aircraft position relative to the RNAV defined path (both lateral and vertical deviation). The display must allow the pilot to readily distinguish if the cross-track deviation exceeds the RNP value (or a smaller value) or if the vertical deviation exceeds 75 feet (or a smaller value).

(a) ***It*** is recommended that an appropriately-scaled non-numeric deviation display (i.e., lateral deviation indicator and vertical deviation indicator) be located in the pilot's primary optimum field of view. A fixed-scale CDI is acceptable as long as the CDI demonstrates appropriate scaling and sensitivity for the intended RNP value and operation. With a scalable CDI, the scale should derive from the selection of RNP, and not require the separate selection of a CDI scale. Alerting and annunciation limits must also match the scaling values. If the equipment uses default RNP values to describe the operational mode (e.g., en route, terminal area and approach), then displaying the operational mode is an acceptable means from which the flight crew may derive the CDI scale sensitivity.

(b) In lieu of appropriately scaled lateral and vertical deviation indicators in the pilot's primary optimum field of view, a numeric display of deviation may be acceptable depending on the flight crew workload and the numeric display characteristics. A numeric display will require additional initial and recurrent flight crew training (see Appendix 5, paragraph 4.b. (3)).

(2) Identification of the Active (To) Waypoint. The navigation system must provide a display identifying the active waypoint either in the pilot's primary optimum field of view, or on a readily accessible and visible display to the flight crew.

(3) Display of Distance and Bearing. The navigation system must provide a display of distance and bearing to the active (To) waypoint in the pilot's primary optimum field of view. Where not viable, a readily accessible page on a control display unit, readily visible to the flight crew, may display the data.

(4) Display of Groundspeed and Time. The navigation system must provide the display of groundspeed and time to the active (To) waypoint in the pilot's primary optimum field

of view. Where not viable, a readily accessible page on a control display unit, readily visible to the flight crew, may display the data.

(5) Display of To/From the active fix. The navigation system must provide a To/From display in the pilot's primary optimum field of view.

(6) Desired Track Display. The navigation system must have the capability to continuously display to the pilot flying the aircraft the RNAV desired track. This display must be on the primary flight instruments for navigation of the aircraft.

(7) Display of Aircraft Track. The navigation system must provide a display of the actual aircraft track (or track angle error) either in the pilot's primary optimum field of view, or on a readily accessible and visible display to the flight crew.

(8) Failure Annunciation. The aircraft must provide a means to annunciate failures of any aircraft component of the RNAV system, including navigation sensors. The annunciation must be visible to the pilot and located in the primary optimum field of view.

(9) Slaved Course Selector. The navigation system must provide a course selector automatically slaved to the RNAV computed path.

(10) RNAV Path Display. Where the minimum flight crew is two pilots, the navigation system must provide a readily visible means for the pilot monitoring to verify the aircraft's RNAV defined path and the aircraft's position relative to the defined path.

(11) Display of Distance to Go. The navigation system must provide the ability to display distance to go to any waypoint selected by the flight crew.

(12) Display of Distance Between Flight Plan Waypoints. The navigation system must provide the ability to display the distance between flight plan waypoints.

(13) Display of Deviation. The navigation system must provide a numeric display of the vertical deviation with a resolution of 10 feet or less, and the lateral deviation with a resolution of 0.01 NM or less.

(14) Display of Barometric Altitude. The aircraft must display barometric altitude from two independent altimetry sources, one in each pilots' primary optimum field of view.

> **NOTE: This display supports an operational cross-check (comparator monitor) of altitude sources. If the aircraft altitude sources are automatically compared, the output of the independent altimetry sources, including independent aircraft static air pressure systems, must be analyzed to ensure that they can provide an alert in the pilot's primary optimum field of view when deviations between the sources exceed ±75 feet. Such comparator monitor function should be documented as it may eliminate the need for an operational mitigation.**

(15) Display of Active Sensors. The aircraft must display the current navigation sensor(s) in use. It is recommended that this display be provided in the primary optimum field of view.

NOTE: This display is used to support operational contingency procedures. If such a display is not provided in the primary optimum field of view, crew procedures may mitigate the need for this display if the workload is determined to be acceptable.

e. Design Assurance. The system design assurance must be consistent with at least a major failure condition for the display of misleading lateral or vertical guidance on an RNP SAAAR approach.

NOTE: The display of misleading lateral or vertical RNP guidance is considered a hazardous (severe-major) failure condition for RNP SAAAR approaches with an RNP value less than RNP 0.3. Systems designed consistent with this effect should be documented as it may eliminate the need for some operational mitigations for the aircraft.

f. Navigation Database.

(1) Navigation Database. The aircraft navigation system must use an on-board navigation database which can:

(a) receive updates in accordance with the AIRAC cycle; and

(b) allow retrieval and loading of RNP SAAAR procedures into the RNAV system.

(2) Database Protection. The onboard navigation database must be protected against flight crew modification of the stored data.

NOTE: When a procedure is loaded from the database, the RNAV system must fly the procedure as published. This does not preclude the flight crew from having the means to modify a procedure or route already loaded into the RNAV system. However, the procedures stored in the navigation database must not be modified and must remain intact within the navigation database for future use and reference.

(3) Display the Validity Period. The aircraft must provide a means to display the validity period for the onboard navigation database to the flight crew.

4. REQUIREMENTS FOR RNP SAAAR APPROACHES WITH RF LEGS. This section defines additional requirements to conduct approaches with RF legs. The AFM or aircraft qualification guidance should identify whether or not this capability is provided.

a. The navigation system must have the capability to execute leg transitions and maintain tracks consistent with an RF leg between two fixes.

b. The aircraft must have an electronic map display of the selected procedure.

c. The FMC, the flight director system and autopilot must be capable of commanding a bank angle up to 30 degrees above 400 feet AGL and up to 8 degrees below 400 feet AGL.

d. Upon initiating a go-around or missed approach (through activation of TOGA or other means), the flight guidance mode should remain in LNAV to enable continuous track guidance during an RF leg.

5. REQUIREMENTS FOR USING LINES OF MINIMA LESS THAN RNP 0.3. The AFM or aircraft qualification guidance should identify whether or not this capability is provided in each aircraft configuration (e.g., dual autopilots may achieve a smaller RNP capability than dual flight director).

a. No single-point-of-failure can cause the loss of guidance compliant with the RNP value associated with the approach. Typically, the aircraft must have at least the following equipment: dual GNSS sensors, dual flight management systems, dual air data systems, dual autopilots, and a single inertial reference unit (IRU).

b. Design Assurance. The system design assurance must be consistent with at least a major failure condition for the loss of lateral or vertical guidance on an RNP SAAAR approach where RNP less than 0.3 is required to avoid obstacles or terrain while executing an approach.

> **NOTE: For RNP SAAAR approach operations requiring less than 0.3 to avoid obstacles or terrain, the loss of the display of lateral guidance is considered a hazardous (severe-major) failure condition. The AFM should document systems designed consistent with this effect. This documentation should describe the specific aircraft configuration or mode of operation that achieves RNP values less than 0.3. Meeting this requirement can substitute for the general requirement for dual equipment described above**

c. Upon initiating a go-around or missed approach (through activation of TOGA or other means), the flight guidance mode should remain in LNAV to enable continuous track guidance during an RF leg. If the aircraft does not provide this capability, the following requirements apply:

(1) If the aircraft supports RF legs, the lateral path after initiating a go-around (TOGA), (given a minimum 50 second straight segment between the RF end point and the DA), must be within 1 degree of the track defined by the straight segment through the DA point (see Figure 3). The prior turn can be of arbitrary angular extent and radius as small as 1 NM, with speeds commensurate with the approach environment and the radius of the turn.

(2) The flight crew must be able to couple the autopilot or flight director to the RNAV system (engage LNAV) by 400 feet AGL.

d. After initiating a go-around or missed approach following loss of GNSS, the aircraft must automatically revert to another means of navigation that complies with the RNP value.

6. REQUIREMENTS FOR APPROACHES WITH A MISSED APPROACH LESS THAN RNP 1.0. The AFM or aircraft qualification guidance should identify whether or not the aircraft can achieve less than RNP 1.0 when executing a missed approach procedure. The AFM or aircraft qualification guidance should also specify the aircraft configuration or mode of operation necessary to achieve RNP values less than 1.0 (e.g., dual autopilots may achieve a smaller RNP capability than dual flight director).

a. No single-point-of-failure can cause the loss of guidance compliant with the RNP value associated with a missed approach procedure. Typically, the aircraft must have at least the following equipment: dual GNSS sensors, dual flight management systems, dual air data systems, dual autopilots, and a single inertial reference unit (IRU).

b. Design Assurance. The system design assurance must be consistent with at least a major failure condition for the loss of lateral or vertical guidance on an RNP SAAAR approach where RNP less than 1.0 is required to avoid obstacles or terrain while executing a missed approach.

NOTE: For RNP SAAAR missed approach operations requiring less than 1.0 to avoid obstacles or terrain, the loss of the display of lateral guidance is considered a hazardous (severe-major) failure condition. The AFM should document systems designed consistent with this effect. This documentation should describe the specific aircraft configuration or mode of operation that achieves RNP values less than 1.0. Meeting this requirement can substitute for the general requirement for dual equipment described above

c. Upon initiating a go-around or missed approach (through activation of TOGA or other means), the flight guidance mode should remain in LNAV to enable continuous track guidance during an RF leg. If the aircraft does not provide this capability, the following requirements apply:

(1) If the aircraft supports RF legs, the lateral path after initiating a go-around (TOGA), (given a minimum 50 second straight segment between the RF end point and the DA), must be within 1 degree of the track defined by the straight segment through the DA point (see Figure 3). The prior turn can be of arbitrary angular extent and radius as small as 1 NM, with speeds commensurate with the approach environment and the radius of the turn.

(2) The flight crew must be able to couple the autopilot or flight director to the RNAV system (engage LNAV) by 400 feet AGL.

d. After initiating a go-around or missed approach following loss of GNSS, the aircraft must automatically revert to another means of navigation that complies with the RNP value.

Public RNP SAAAR Procedures
Minimum Straight Segments between Turns and Decision Altitude

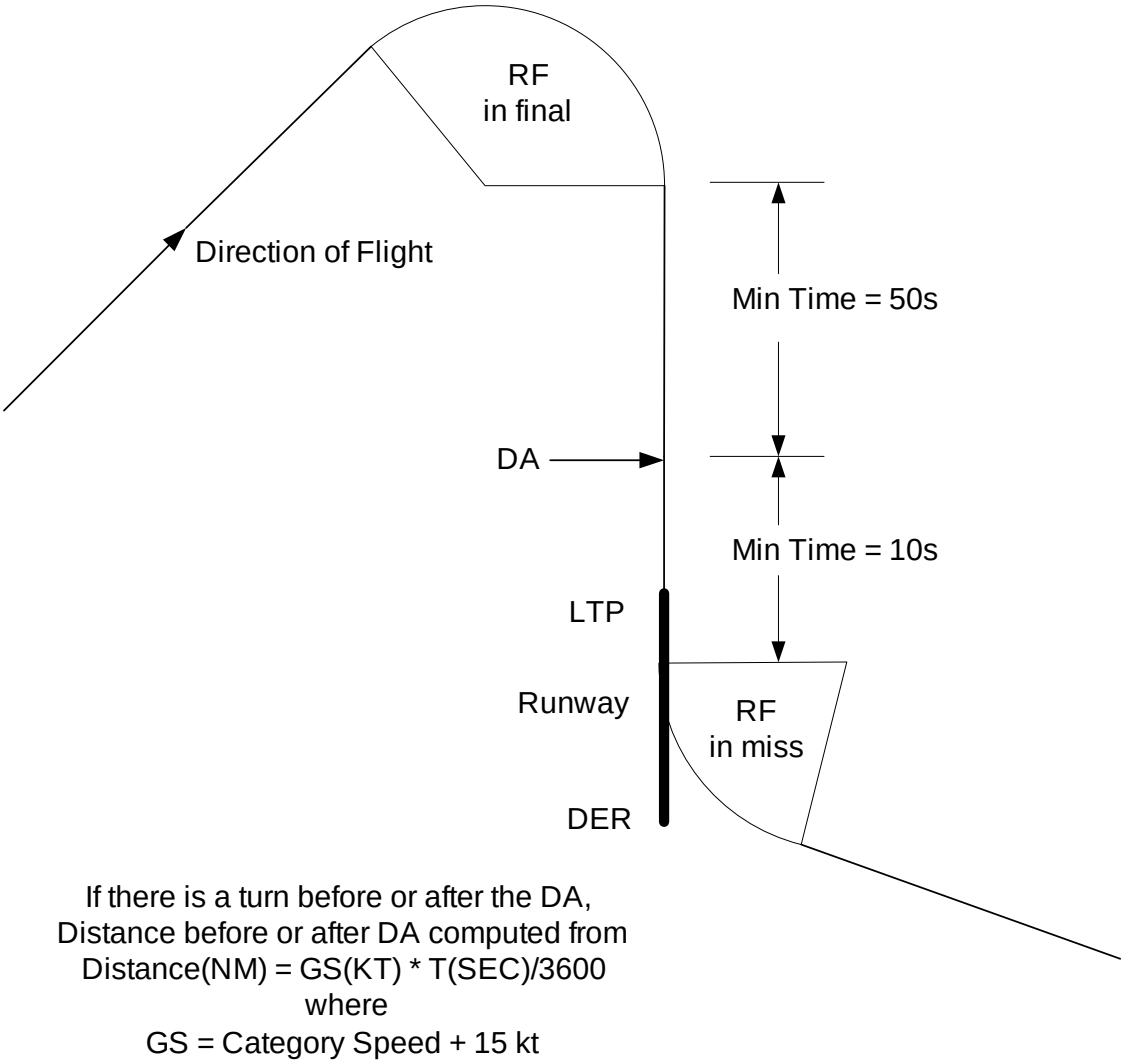

Figure 3. Minimum Straight Path Before DA

APPENDIX 3. NAVIGATION DATA VALIDATION PROGRAM

1. INTRODUCTION. The procedure stored in the navigation database defines the lateral and vertical guidance. Navigation database updates occur every 28 days, and the navigation data in every update is critical to the integrity of every RNP SAAAR approach operation. Given the reduced obstacle clearance associated with these approaches, validation of navigation data warrants special consideration. This appendix provides guidance for the operator's procedures for validating the navigation data associated with RNP SAAAR approaches.

2. DATA PROCESS

a. The operator must identify the responsible manager for the data updating process within their procedures.

b. The operator must document a process for accepting, verifying and loading navigation data into the aircraft.

c. The operator must place their documented data process under configuration control.

3. INITIAL DATA VALIDATION. The operator must validate every RNP SAAAR procedure before flying the procedure in instrument meteorological conditions (IMC) to ensure compatibility with their aircraft and to ensure the resulting path matches the published procedure. As a minimum, the operator must:

a. Compare the navigation data for the procedure(s) to be loaded into the flight management system with the published procedure. The FAA Form 8260 series is available through the National Flight Data Center.

b. Validate the loaded navigation data for the procedure, either in a simulator or in the actual aircraft in visual meteorological conditions (VMC). The depicted procedure on the map display must be compared to the published procedure. The entire procedure must be flown to ensure the path is flyable, does not have any apparent lateral or vertical path disconnects, and is consistent with the published procedure.

c. Once the procedure is validated, retain and maintain a copy of the validated navigation data for comparison to subsequent data updates.

4. DATA UPDATES. Upon receipt of each navigation data update, and before using the navigation data in the aircraft, the operator must compare the update to the validated procedure. This comparison must identify and resolve any discrepancies in the navigation data. If there are significant changes (any change affecting the approach path or performance) to any portion of a procedure and an amended FAA Form 8260-3 or –10 verifies the changes, the operator must validate the amended procedure in accordance with paragraph 3 of this Appendix.

5. DATA SUPPLIERS. Data suppliers must have a Letter of Acceptance (LOA) for processing navigation data in accordance with AC 20-153. An LOA recognizes the data supplier as one whose data quality, integrity and quality management practices are consistent with the criteria of DO-200A. The operator's supplier (e.g., FMS company) must have a Type 2 LOA, and their respective suppliers must have a Type 1 or 2 LOA.

6. AIRCRAFT MODIFICATIONS. If an aircraft system required for RNP SAAAR is modified (e.g., software change), the operator is responsible for validation of RNP SAAAR procedures with the navigation database and the modified system. This may be accomplished without any direct evaluation if the manufacturer verifies that the modification has no effect on the navigation database or path computation. If no such assurance from the manufacturer is available, the operator must conduct initial data validation with the modified system.

APPENDIX 4. OPERATIONAL CONSIDERATIONS

1. GENERAL. This appendix provides guidance on the conduct of RNP SAAAR approach operations. In addition to the guidance of this appendix, the operator must continue to ensure they comply with the general RNAV operating requirements; checking Notices to Airmen (NOTAMS), availability of Navigational Aids (NAVAID), airworthiness of aircraft systems, and aircrew qualification.

2. PREFLIGHT CONSIDERATIONS.

a. Minimum Equipment List. Operators minimum equipment list should be developed /revised to address the equipment requirements for RNP SAAAR instrument approaches. Guidance for these equipment requirements is available from the aircraft manufacturer and appendix 2 to this advisory circular. The required equipment may depend on the intended RNP value and whether or not the missed approach requires RNP less than 1.0. For example, GNSS and autopilot are typically required for small RNP values. Dual equipment is typically required for approaches when using a line of minima less than RNP 0.3 and/or where the missed approach has an RNP less than 1.0. An operable Class A Terrain Awareness Warning System (TAWS) is required for all RNP SAAAR procedures. It is recommended that the TAWS use altitude that is compensated for local pressure and temperature effects (e.g., corrected barometric and GNSS altitude), and include significant terrain and obstacle data. The flight crew must be cognizant of the required equipment.

b. Autopilot and Flight Director. RNP SAAAR procedures with RNP values less than RNP 0.3 or with RF legs require the use of autopilot or flight director driven by the RNAV system in all cases. Thus, the autopilot/flight director must operate with suitable accuracy to track the lateral and vertical paths required by a specific RNP SAAAR procedure. When the dispatch of a flight is predicated on flying an RNP SAAAR approach requiring the autopilot at the destination and/or alternate, the dispatcher must determine that the autopilot is installed and operational.

c. Dispatch RNP Assessment. The operator must have a predictive performance capability, which can forecast whether or not the specified RNP will be available at the time and location of a desired RNP SAAAR operation. This capability can be a ground service and need not be resident in the aircraft's avionics equipment. The operator must establish procedures requiring use of this capability as both a preflight dispatch tool and as a flight-following tool in the event of reported failures. The RNP assessment must consider the specific combination of the aircraft capability (sensors and integration).

(1) RNP assessment when GNSS updating. This predictive capability must account for known and predicted outages of GNSS satellites or other impacts on the navigation system's sensors. The prediction program should not use a mask angle below 5 degrees, as operational experience indicates that satellite signals at low elevations are not reliable. The prediction must use the actual GPS constellation with the (RAIM) (or equivalent) algorithm identical to that used in the actual equipment. For RNP SAAAR approaches with high terrain, use a mask angle appropriate to the terrain.

(2) Initially, RNP SAAAR procedures require GNSS updating. Therefore, there is no RNP assessment associated with DME/DME or VOR/DME updating of the aircraft's RNAV system.

d. NAVAID Exclusion. The operator must establish procedures to exclude NAVAID facilities in accordance with NOTAMs (e.g., DMEs, VORs, localizers). Internal avionics reasonableness checks may not be adequate for RNP SAAAR operations.

e. Navigation Database Currency. During system initialization, pilots of aircraft equipped with an RNAV-certified system, must confirm that the navigation database is current. Navigation databases are expected to be current for the duration of the flight. If the AIRAC cycle will change during flight, operators and pilots must establish procedures to ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. Traditionally, this has been accomplished by verifying electronic data against paper products. One acceptable means is to compare aeronautical charts (new and old) to verify navigation fixes prior to dispatch. If an amended chart is published for the procedure, the database must not be used to conduct the operation.

3. IN-FLIGHT CONSIDERATIONS.

a. Modification of Flight Plan. Pilots are not authorized to fly a published RNP SAAAR procedure unless it is retrievable by the procedure name from the aircraft navigation database and conforms to the charted procedure. The lateral path must not be modified; with the exception of accepting a clearance to go direct to a fix in the approach procedure that is before the FAF and that does not immediately precede an RF leg. The only other modification to the loaded procedure is to change altitude and/or airspeed waypoint constraints on the initial, intermediate, or missed approach segments (e.g., to apply cold temperature corrections or comply with an ATC clearance/instruction).

b. Required List of Equipment. The flight crew must have a required list of equipment for conducting RNP SAAAR approaches or alternate methods to address in flight equipment failures that would prohibit RNP SAAAR approaches (e.g. quick reference handbook).

c. RNP Management. The flight crew's operating procedures must ensure the navigation system uses the appropriate RNP values throughout the approach. If multiple lines of minima associated with different RNP values are shown on the approach chart, the crew must confirm that the desired RNP value is entered in the RNAV system. If the navigation system does not extract and set the RNP value from the on-board navigation database for each leg of the procedure, then the flight crew's operating procedures must ensure that the smallest RNP value required to complete the approach or the missed approach is selected before initiating the approach (e.g., before the initial approach fix (IAF)). Different IAF's may have different RNP values, which are annotated on the approach chart.

d. GNSS Updating. Initially all RNP SAAAR instrument procedures require GNSS updating of the navigation position solution. The flight crew must verify GNSS updating is available prior to commencing the RNP SAAAR approach. During the approach, if at any time GNSS updating is lost and the navigation system does not have the performance to continue the

approach, the flight crew must abandon the RNP SAAAR approach unless visual conditions exist between the aircraft and the runway of intended landing.

e. Radio Updating. Initiation of all RNP SAAAR procedures is based on GNSS updating. Except where specifically designated on a procedure as Not Authorized, DME/DME updating can be used as a reversionary mode during the approach or missed approach when the system complies with the RNP value. VOR updating is not authorized at this time. The flight crew must comply with the operator's procedures for inhibiting specific facilities (see paragraph 2d of this Appendix).

f. Approach Procedure Confirmation. The flight crew must confirm that the correct procedure has been selected. This process includes confirmation of the waypoint sequence, reasonableness of track angles and distances, and any other parameters that can be altered by the pilot, such as altitude or speed constraints. A procedure must not be used if validity of the navigation database is in doubt. A navigation system textual display or navigation map display must be used.

g. Track Deviation Monitoring. Operational qualification for RNP SAAAR procedures requires flight crew monitoring of lateral and vertical cross-track deviations on the pilot's primary flight display (PFD) to ensure the aircraft remains within the bounds defined by the procedure. The deviation must be monitored, and action taken to minimize errors. The flight crew must initiate a go-around if either a lateral or vertical deviation is too large unless visual conditions exist between the aircraft and the runway of intended landing. The deviation limits must not exceed 1xRNP laterally and 75 feet vertically.

(1) Some aircraft navigation displays do not incorporate lateral and vertical deviations scaled for each RNP SAAAR operation in the primary optimum field of view. Where a moving map, low-resolution vertical deviation indicator (VDI), or numeric display of deviations are to be used, flight crew training and procedures must ensure the effectiveness of these displays. Typically, this involves demonstration of the procedure with a number of trained crews and inclusion of this monitoring procedure in the recurrent RNP SAAAR training program.

(2) For installations that use a CDI for lateral path tracking, the aircraft flight manual (AFM) or aircraft qualification guidance should state which RNP values and operations the aircraft supports and the operational effects on the CDI scale. The flight crew must know the CDI full-scale deflection value. The avionics may automatically set the CDI scale (dependent on phase of flight) or the flight crew may manually set the scale. If the flight crew manually selects the CDI scale, the operator must have procedures and training in place to assure the selected CDI scale is appropriate for the intended RNP operation. The deviation limit must be readily apparent given the scale (e.g., full-scale deflection).

h. System Crosscheck. For approaches with RNP value less than RNP 0.3, the flight crew must monitor the lateral and vertical guidance provided by the navigation system by ensuring it is consistent with other available data and displays provided by an independent means.

NOTE: This crosscheck may not be necessary if the lateral and vertical guidance systems have been developed consistent with a hazardous (severe-major) failure

condition for misleading information (see Appendix 2, paragraph 3e) and if the normal system performance supports airspace containment (Appendix 2, paragraph 2d).

i. Procedures with RF Legs. An RNP SAAAR procedure may require the ability to execute an RF leg to avoid terrain or obstacles. As not all aircraft have this capability, flight crews must be aware of whether or not they can conduct these procedures. When flying an RF leg, flight crew compliance with the desired path is essential to maintain the intended ground track.

(1) If initiating a go-around during or shortly after the RF leg, the flight crew must be aware of the importance of maintaining the published path as closely as possible. Operational procedures are required for aircraft that do not stay in LNAV when a go-around is initiated to ensure the RNP SAAAR ground track is maintained.

(2) Pilots must not exceed the maximum airspeeds shown in Table 1 (below) throughout the RF leg segment. For example, a Category C A320 must slow to 140 KIAS at the FAF or may fly as fast as 165 KIAS if using Category D minima. A missed approach prior to DA may require the segment speed for that segment be maintained.

Table 1

Indicated Airspeed (Knots)					
Segment	Indicated Airspeed by Aircraft Category				
	Cat A	Cat B	Cat C	Cat D	Cat E
Initial & Intermediate (IAF to FAF)	150	150	240	250	250
Final (FAF to DA)	90	120	140	165	As Specified
Missed Approach (DA to MAHP)	110	150	240	265	As Specified
Airspeed Restriction*	As specified				

*Airspeed restrictions may be used to reduce turn radius.

j. Temperature Compensation. For aircraft with temperature compensation in accordance with Appendix 2, paragraph 3a(7), flight crews may disregard the temperature limits on RNP SAAAR procedures if the operator provides pilot training on the use of the temperature compensation function. Temperature compensation by the system is applicable to the VNAV guidance and is not a substitute for the flight crew compensating for the cold temperature effects on minimum altitudes or the decision altitude.

k. Altimeter Setting. Due to the reduced obstruction clearance inherent in RNP SAAAR instrument procedures, the flight crew must verify the most current airport altimeter is set prior to the final approach fix (FAF) but no earlier than the IAF. Execution of an RNP SAAAR instrument procedure requires the current altimeter setting for the airport of intended landing. Remote altimeter settings are not allowed.

l. Altimeter Crosscheck. The flight crew must complete an altimetry crosscheck ensuring both pilots' altimeters agree within ±75 feet prior to the final approach fix (FAF) but no earlier

than the IAF. If the altimetry crosscheck fails then the procedure must not be continued. If the avionics systems provide a comparator warning system for the pilots' altimeters, the flight crew procedures should also address actions to take if a comparator warning for the pilots' altimeters occurs while conducting an RNP SAAAR procedure.

NOTE: This operational crosscheck is not necessary if the aircraft automatically compares the altitudes to within 75 feet (see also Appendix 2, paragraph 3d(15)).

m. Non-Standard Climb Gradient. When the operator plans to use the DA associated with a non-standard missed approach climb gradient, he must ensure the aircraft will be able to comply with the published climb gradient for the planned aircraft loading, atmospheric conditions and operating procedures before conducting the operation. Where operators have performance personnel that determine if their aircraft can comply with published climb gradients, information should be provided to the pilots indicating the climb gradient they can expect to achieve.

n. Engine-Out Procedures. Guidance for qualification of conducting engine-out approach procedures and developing engine-out extraction procedures is provided in FAA Notice 8400.80.

o. Go-Around or Missed Approach.

(1) Missed approach procedures that require RNP 1.0. Where possible, the missed approach will require RNP 1.0. The missed approach portion of these procedures is similar to a missed approach of an RNAV (GPS) approach.

(2) Missed approach procedures that require less than RNP 1.0. Where necessary, RNP values less than RNP 1 .0 will be used in the missed approach. To be approved to conduct approaches that specify "Missed approach requires RNP less than 1.0", equipage and procedures must meet Appendix 2 criteria (Requirements for Approaches With A Missed Approach less than RNP 1.0).

(3) In many aircraft when executing a go-around or missed approach activating Take-off/Go-around (TOGA) may cause a change in lateral navigation. In many aircraft, activating TOGA disengages the autopilot and flight director from LNAV guidance, and the flight director reverts to track-hold derived from the inertial system. LNAV guidance to the autopilot and flight director should be re-engaged as quickly as possible.

(4) The flight crew procedures and training must address the impact on navigation capability and flight guidance if the pilot initiates a go-around while the aircraft is in a turn.

(5) Upon loss of GNSS updates, the RNAV guidance may begin to "coast" on IRU, if installed, and drift, degrading the navigation position solution. Thus, when the RNP SAAAR missed approach operations rely on IRU "coasting" the inertial guidance can only provide RNP guidance for a specified amount of time.

p. Contingency Procedures.

(1) Failure while En Route. The aircraft RNP capability is dependent on operational aircraft equipment and GNSS satellites. The flight crew must be able to assess the impact of

equipment failure on the anticipated RNP SAAAR approach and take appropriate action. As described in paragraph 2c of this Appendix, the flight crew also must be able to assess the impact of changes in the GNSS constellation and take appropriate action.

(2) Failure on Approach. The operator's contingency procedures need to address at least the following conditions:

- Failure of the RNP system components, including those affecting lateral and vertical deviation performance (e.g., failures of a GPS sensor, the flight director or automatic pilot)

- Loss of navigation signal-in-space (loss or degradation of external signal)

APPENDIX 5. TRAINING

1. INTRODUCTION. The operator must provide training for key personnel (e.g., flight crewmembers and dispatchers) in the use and application of RNP SAAAR approach procedures. A thorough understanding of the operational procedures and best practices is critical to the safe operation of aircraft during RNP SAAAR operations. This program must provide sufficient detail on the aircraft's navigation and flight control systems to enable the pilots to identify failures affecting the aircrafts RNP capability and the appropriate abnormal/emergency procedures. Required training must include both knowledge and skill assessments of the crewmembers and dispatchers duties.

a. Flight crew Training.

(1) Each operator is responsible for the training of flight crews for the specific RNP SAAAR operations exercised by the operator. The operator must include training on the different types of RNP SAAAR procedures and required equipment. Training must include discussion of RNP SAAAR regulatory requirements. The operator must include these requirements and procedures in their flight operations and training manuals (as applicable). This material must cover all aspects of the operator's RNP SAAAR operations including the applicable FAA authorization (Ops Specs, MSpecs or LOA). An individual must have completed the appropriate ground and or flight training segment before engaging in RNP SAAAR operations.

(2) Flight training segment's must include training and checking modules representative of the type of RNP SAAAR operations the operator conducts during line flying activities. Many operators may train for RNP SAAAR procedures under the established training standards and provisions for Advanced Qualification Programs (AQP). They may conduct evaluations in Line Oriented Flight Training (LOFT) scenarios, Selected Event Training (SET) scenarios or in a combination of both. The operator may conduct required flight-training modules in Flight Training Devices, Aircraft Simulators, and other enhanced training devices as long as these training mediums accurately replicate the operator's equipment and RNP SAAAR approach operations.

b. Part 121, 125, 129, 91K, and 135 Flight crew Qualification Training.

(1) Operators must address initial RNP SAAAR training and qualifications during initial, transition, upgrade, recurrent, differences, or stand-alone training and qualification programs in a respective qualification category. The qualification standards assess each pilot's ability to properly understand and use RNP SAAAR approach procedures (RNP SAAAR Initial Evaluation). The operator must also develop recurrent qualification standards to ensure their flight crews maintain appropriate RNP SAAAR knowledge and skills (RNP SAAAR Recurrent Qualification).

(2) Operators may address RNP SAAAR operation topics separately or integrate them with other curriculum elements. For example, an RNP SAAAR flight crew qualification may key on a specific aircraft during transition, upgrade, or differences courses. General training may also address RNP SAAAR qualification (e.g., during recurrent training or checking events such as recurrent proficiency check/proficiency training (PC/PT), line oriented evaluation (LOE)

or special purpose operational training (SPOT)). A separate, independent RNP SAAAR qualification program may also address RNP SAAAR training (e.g., by completion of a special RNP SAAAR curriculum at an operator's training center or at designated crew bases).

(3) Credit for Use of an operators existing approved RNP training program. Operators intending to receive credit for RNP training, when their proposed program relies on previous training (e.g., Special RNP IAP's) must receive specific authorization from their Principal Operations Inspector (POI). In addition to the current RNP training program the air carrier will need to provide differences training between existing training program and the RNP SAAAR training requirements.

c. Flight Dispatcher Training. Training for flight dispatchers must include: training on the different types of RNP SAAAR procedures, the importance of specific navigation equipment and other equipment during RNP SAAAR approach operations and discuss RNP SAAAR regulatory requirements and procedures. Dispatcher procedure and training manual's must include these requirements (as applicable). This material must cover all aspects of the operator's RNP SAAAR operations including the applicable FAA authorization (Ops Specs, MSpecs or LOA). An individual must have completed the appropriate training course before engaging in RNP SAAAR operations. Additionally, the dispatchers' training must address how to determine: RNP SAAAR availability (considering aircraft equipment capabilities), MEL requirements, aircraft performance, and navigation signal availability (e.g., GPS RAIM/predictive RNP capability tool) for destination and alternate airports.

2. GROUND TRAINING SEGMENTS. Ground training segments must address the following subjects as training modules in approved RNP SAAAR academic training during the initial introduction of a crewmember to RNP SAAAR systems and operations. For recurrent programs, the curriculum need only review initial curriculum requirements and address new, revised, or emphasized items.

a. General Concepts of RNP SAAAR Operation. RNP SAAAR academic training must cover RNP SAAAR systems theory to the extent appropriate to ensure proper operational use. Flight crews must understand basic concepts of RNP SAAAR systems operation, classifications, and limitations. The training must include general knowledge and operational application of RNP SAAAR instrument approach procedures. This training module must address the following specific elements:

(1) Definitions of RNAV, RNAV (GPS), RNP, RNP SAAAR, RAIM, and containment areas.

(2) The differences between RNAV and RNP.

(3) The types of RNP SAAAR approach procedures and familiarity with the charting of these procedures.

(4) The programming and display of RNP and aircraft specific displays (e.g., Actual Navigation Performance).

(5) How to enable and disable the navigation updating modes related to RNP.

(6) RNP values appropriate for different phases of flight and RNP SAAAR instrument procedures and how to select (if required).

(7) The use of GPS RAIM (or equivalent) forecasts and the effects of RAIM "holes" on RNP SAAAR procedures (flight crew and dispatchers).

(8) When and how to terminate RNP navigation and transfer to traditional navigation due to loss of RNP and/or required equipment.

(9) How to determine if the FMC database is current, contains required navigational data for use of GPS waypoints.

(10) Explanation of the different components that contribute to the total system error and their characteristics (e.g., effect of temperature on baro-VNAV, drift characteristics when using IRU with no radio updating).

(11) Temperature Compensation. Flight crews operating avionics systems with compensation for altimetry errors introduced by deviations from ISA may disregard the temperature limits on RNP SAAAR procedures, if pilot training on use of the temperature compensation function is provided by the operator and the compensation function is utilized by the crew. However the training must also recognize the temperature compensation by the system is applicable to the VNAV guidance and is not a substitute for the flight crew compensating for the cold temperature effects on minimum altitudes or the decision altitude.

b. ATC Communication and Coordination for Use of RNP SAAAR. Ground training must instruct the flight crews on proper flight plan classifications and any Air Traffic Control (ATC) procedures applicable to RNP SAAAR operations. The flight crews must receive instruction on the need to advise ATC immediately when the performance of the aircraft's navigation system is no longer suitable to support continuation of an RNP SAAAR procedure. Flight crews must also know what navigation sensors form the basis for their RNP SAAAR compliance, and they must be able to assess the impact of failure of any avionics or a known loss of ground systems on the remainder of the flight plan.

c. RNP SAAAR Equipment Components, Controls, Displays, and Alerts. Academic training must include discussion of RNP terminology, symbology, operation, optional controls, and display features including any items unique to an operator's implementation or systems. The training must address applicable failure alerts and limitations. The flight crews and dispatchers should achieve a thorough understanding of the equipment used in RNP operations and any limitations on the use of the equipment during those operations.

d. AFM Information and Operating Procedures. The AFM or other aircraft eligibility evidence must address normal and abnormal flight crew operating procedures, responses to failure alerts, and any limitations, including related information on RNP modes of operation. Training must also address contingency procedures for loss or degradation of RNP capability. The flight operations manuals approved for use by the flight crews (e.g., Flight Operations Manual (FOM) or Pilot Operating Handbook (POH)) should contain this information.

e. MEL Operating Provisions. Flight crews must have a thorough understanding of the MEL requirements supporting RNP SAAAR operations.

3. FLIGHT TRAINING SEGMENTS. In addition to the academic training, the flight crews must receive appropriate operational use training. Training programs must cover the proper execution of RNP SAAAR procedures in concert with the OEM's documentation. The operational training must include RNP SAAAR procedures and limitations; standardization of the set-up of the cockpit's electronic displays during an RNP SAAAR procedure; recognition of the aural advisories, alerts and other annunciations that can impact compliance with an RNP SAAAR procedure; and the timely and correct responses to loss of RNP SAAAR capability in a variety of scenarios embracing the breadth of the RNP SAAAR procedures the operator plans to complete. Such training may also use approved flight training devices or simulators. This training must address the following specific elements:

a. Procedures for verifying that each pilot's altimeter has the current setting before beginning the final approach of an RNP SAAAR procedure, including any operational limitations associated with the source(s) for the altimeter setting and the latency of checking and setting the altimeters approaching the FAF.

b. Use of aircraft RADAR, TAWS, GPWS, or other avionics systems to support the flight crew's track monitoring and weather and obstacle avoidance.

c. The effect of wind on aircraft performance during RNP SAAAR procedures and the need to positively remain within RNP containment area, including any operational wind limitation and aircraft configuration essential to safely complete an RNP SAAAR procedure.

d. The effect of groundspeed on compliance with RNP SAAAR procedures and bank angle restrictions that may impact the ability to remain on the course centerline. For RNP procedures aircraft are expected to maintain the standard speeds associated with applicable category.

e. Relationship between RNP and the appropriate approach minima line on an approved published RNP SAAAR procedure and any operational limitations if the available RNP degrades or is not available prior to an approach (this should include flight crew procedures outside the FAF versus inside the FAF).

f. Concise and complete flight crew briefings for all RNP SAAAR procedures and the important role Cockpit Resource Management (CRM) plays in successfully completing an RNP SAAAR procedure.

g. Understanding alerts that may occur from the loading and use of improper RNP values for a desired segment of an RNP SAAAR procedure.

h. Understanding the performance requirement to couple the autopilot/flight director to the navigation system's lateral guidance on RNP SAAAR procedures requiring an RNP of less than RNP 0.3.

i. The importance of aircraft configuration to ensure the aircraft maintains any required speeds during RNP SAAAR procedures.

j. The events that trigger a missed approach when using the aircraft's RNP capability to complete an RNP SAAAR procedure.

k. Any bank angle restrictions or limitations on RNP SAAAR procedures.

l. The potentially detrimental effect of reducing the flap setting, reducing the bank angle or increasing airspeeds may have on the ability to comply with an RNP SAAAR procedure.

m. Develop flight crew knowledge and skills necessary to properly conduct RNP SAAAR operations (RNP SAAAR Procedure Training).

n. Ensure flight crews understand and are capable of programming and operating the FMC, autopilot, autothrottles, RADAR, GPS, INS, EFIS (including the moving map), and TAWS in support of RNP SAAAR procedures.

o. Handling of TOGA while in a turn,

p. Monitoring of FTE and related go-around operation,

q. Handling of loss of GPS during a procedure,

r. Ensuring flight crews understand the performance issues associated with reversion to radio updating, know any limitations on the use of DME and VOR updating.

s. Flight crew contingency procedures for a loss of RNP capability during a missed approach. Due to the lack of navigation guidance, the training should emphasize the flight crew contingency actions that achieve separation from terrain and obstacles. The operator should tailor these contingency procedures to their specific, approved SAAAR procedures.

t. As a minimum, each pilot must complete two RNP approach procedures that employ the unique SAAAR characteristics of the operator's approved procedures (i.e., RF legs, RNP missed). One procedure must culminate in a transition to landing and one procedure must culminate in execution of an RNP missed approach procedure.

4. EVALUATION MODULE.

a. Initial Evaluation of RNP SAAAR Knowledge and Procedures. The operator must evaluate each individual flight crewmember on their knowledge of RNP SAAAR procedures prior to employing RNP SAAAR procedures. As a minimum, the review must include a thorough evaluation of pilot procedures and specific aircraft performance requirements for RNP SAAAR operations. An acceptable means for this initial assessment includes one of the following:

(1) An evaluation by an authorized instructor evaluator or check airman using an approved simulator or training device.

(2) An evaluation by an authorized instructor evaluator or check airman during line operations, training flights, PC/PT events, operating experience, route checks, and/or line checks.

(3) Line Oriented Flight Training (LOFT)/Line Oriented Evaluation (LOE). LOFT/LOE programs using an approved simulator that incorporates RNP operations that employ the unique SAAAR characteristics (i.e., RF legs, RNP missed) of the operator's approved procedures.

b. Specific elements that must be addressed in this evaluation module are:

(1) Demonstrate the use of any RNP SAAAR limits/minimums that may impact various RNP SAAAR approaches.

(2) Demonstrate the application of radio-updating procedures, such as enabling and disabling ground-based radio updating of the FMC (i.e., DME/DME and VOR/DME updating) and knowledge of when to use this feature. If the aircraft's avionics do not include the capability to disable radio updating, then the training must ensure the flight crew is able to accomplish the operational actions that mitigate the lack of this feature.

(3) Demonstrate the ability to monitor the actual lateral and vertical flight paths relative to programmed flight path and complete the appropriate flight crew procedures when exceeding a lateral or vertical FTE limit.

(4) Demonstrate the ability to read and adapt to a RAIM (or equivalent) forecast including forecasts predicting a lack of RAIM availability.

(5) Demonstrate the proper setup of the FMC, the weather RADAR, TAWS, and moving map for the various RNP SAAAR operations and scenarios the operator plans to implement.

(6) Demonstrate the use of flight crew briefings and checklists for RNP SAAAR operations with emphasis on CRM.

(7) Demonstrate knowledge of and ability to perform an RNP SAAAR missed approach procedure in a variety of operational scenarios (i.e., loss of navigation or failure to acquire visual conditions).

(8) Demonstrate speed control during segments requiring speed restrictions to ensure compliance with an RNP SAAAR procedure.

(9) Demonstrate competent use of RNP SAAAR approach plates, briefing cards, and checklists.

(10) Demonstrate the ability to complete a stable RNP SAAAR approach: bank angle, speed control, and remaining on the procedure's centerline.

(11) Know the operational limit for deviation below the desired flight path on an RNP SAAAR approach and how to accurately monitor the aircraft's position relative to vertical flight path.

5. RECURRENT TRAINING OF RNP SAAAR KNOWLEDGE AND PROCEDURES.

a. RNP SAAAR Recurrent Training. The operator should incorporate recurrent RNP training that employs the unique SAAAR characteristics of the operator's approved procedures as part of the overall program.

b. A minimum of two RNP SAAAR approaches must be flown by each pilot for each duty position (pilot flying and pilot monitoring), with one culminating in a landing and one

culminating in a missed approach, and may be substituted for any required “precision-like” approach.

NOTE: Equivalent RNP approaches may be credited toward this requirement.

APPENDIX 6. RNP MONITORING PROGRAM

1. The operator must have an RNP monitoring program to ensure continued compliance with the guidance of this AC and to identify any negative trends in performance. At a minimum, this program must address the following information. During the interim approval, the operator must submit the following information every 30 days to the CHDO or FSDO granting their authorization. Thereafter, the operator must continue to collect and periodically review this data to identify potential safety concerns, and maintain summaries of this data.

a. Total number of RNP SAAAR procedures conducted.

b. Number of satisfactory approaches by aircraft/system (Satisfactory if completed as planned without any navigation or guidance system anomalies).

c. Reasons for unsatisfactory approaches, such as:
   1) UNABLE REQ NAV PERF, NAV ACCUR DOWNGRAD, or other RNP messages during approaches.
   2) Excessive lateral or vertical deviation.
   3) TAWS warning.
   4) Autopilot system disconnect.
   5) Nav data errors.
   6) Pilot report of any anomaly.

d. Crew comments:

APPENDIX 7. APPROVAL CHECKLIST/APPLICATION CONTENTS

DRAFT
RNP SAAAR APPROVAL CHECKLIST

Date Application Submitted: _____

1. **Aircraft Qualification** ☐
2. **Navigation Data Validation Program** ☐
3. **Established Maintenance Procedures** ☐
4. **Training (e.g., flight crew/dispatch)** ☐
5. **MEL Revision (as required)** ☐
6. **Operational Procedures Requirements** ☐
7. **RNP monitoring program** ☐
8. **Conditions or Limitations for approval** ☐
9. **Dispatch/flight following procedures** ☐
10. **Validation successfully completed (as required)** ☐

POI ACTION:

Interim RNP SAAAR Approval (issue LOA or OpSpecs/MSpecs) ☐
Final RNP SAAAR Approval (issue LOA or OpSpecs/Mspecs) ☐
RNP SAAAR Disapproval ☐

Reason for Disapproval:

Date: _____

POI Signature: _____

RNP SAAAR Application Package Contents

The operator submits documentation of its proposed operation to its CHDO or local FSDO. The package should include, as a minimum, the following:

1. Aircraft qualification documentation. Documentation from the aircraft manufacturer showing that the proposed aircraft equipment meets the requirements of this AC as outlined in appendix 2. This documentation should contain any specific hardware or software equipment requirements, procedural requirements, and limitations.

2. Type of aircraft and description of aircraft equipment to be used. Provide a configuration list that details pertinent components and equipment to be used for the operation. The list should include each make, model, and version of FMS software installed.

3. Operating procedures and practices. Company manuals must adequately address the special characteristics of a proposed area of operation and the operational (navigation) practices and procedures identified in appendix 5 of this AC. Part 91 operators should confirm they will be operating using procedures and practices identified.

4. Navigation Data Validation Program. The specifics of the Navigation Data Validation Program as depicted in appendix 3 of this AC.

5. Flight crew training programs. Operators must submit training syllabi and other appropriate material to show that operations are incorporated into their programs. Training programs must adequately address the special characteristics of a proposed area of operation and the operational (navigation) practices and procedures identified in appendix 4 of this AC.

6. Simulator training. Operators should submit a description of the training to be conducted using simulation, credit given for simulation, simulator qualification, and how this training is used for line pilot qualification.

7. Dispatcher/flight follower training. Operators should submit training syllabi and other appropriate material to show that dispatch/flight following procedures identified in appendix 5 of this AC.

8. Operations manuals and checklists. Operators should submit manuals and checklists that include information/guidance to be used for specific operations requested. Part 91 operators should submit AFMs and required supplements for the aircraft to be used in the operation.

9. Maintenance procedures. The operator should submit maintenance procedures that include instructions for airworthiness/maintenance of the equipment/systems to be used in the operation and required training for maintenance personnel. The operator must provide a procedure for removing the aircraft from and returning the aircraft to RNP SAAAR operational capability.

10. RNP SAAAR approach monitoring program. The operator must submit a program that collects data on RNP SAAAR procedures conducted. Each operation should be recorded, and

unsuccessful attempts should include the factors that prevented successful completion of the operation.

11. MEL. The operator should submit any revisions to the MEL necessary for the conduct of the operation.

12. Validation. The operator should submit a validation test plan to show the operator is capable of the requested operation. (See Order 8400.10, chapter 9, for guidance and requirements of validation tests.) The validation plan should include at least the following:

a. The validation plan should be designed to demonstrate the aircraft capability to perform RNP procedures with SAAAR.
b. The carriers operational and dispatch procedures.
c. The effectiveness of the carriers training.
d. The effectiveness of the equipment maintenance procedures.
e. MEL procedures.

NOTE: The validation plan should take advantage of ground training devices, simulators, and aircraft demonstrations. If the demonstration will be conducted in an aircraft, it must be completed in day VMC.

NOTE: Demonstration may be required in each make, model, and version of FMS software installed.

13. Proposed language, e.g., non-standard OpSpecs/Mspecs/LOA, that identifies any conditions or limitations necessary or required for the authorization.